strengthening program. Thus, a patient's health status should not be a barrier for joining exercise programs. Further research is however required due to the low sample size of our study.

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DEVELOPMENT OF COMORBIDITY-ADAPTED EXERCISE PROTOCOLS FOR PATIENTS WITH KNEE OSTEOARTHRITIS

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Purpose: The purpose of this study was to develop comorbidity-adapted exercise protocols for patients with knee OA and comorbidity. Method: Several steps were undertaken to develop comorbidity-adapted protocols: selection of highly prevalent comorbidities in OA, a literature search to identify restrictions and contraindications for exercise therapy for the various comorbid diseases, consultation of experts on each comorbid disease, and field testing of the protocol in 11 patients with knee OA and comorbidity.
Results: Based on literature and expert opinion, comorbidity-adapted protocols were developed for highly prevalent comorbidities in OA. Field testing showed that the protocols provided guidance in clinical decision making in both the diagnostic and the treatment phase. Because of overlap, the number of exercise protocols could be reduced to three: one for physiological adaptations (coronary disease, heart failure, diabetes type 2, chronic obstructive pulmonary diseases, obesity), one for behavioural adaptations (chronic a-specific pain, chronic low back pain, depression), and one for environmental adaptations (visual or hearing impairments). Evaluation of patient outcome after treatment showed significant ($p < 0.05$) and clinically relevant improvements in activity limitations and pain.
Conclusion: Comorbidity-adapted exercise protocols for patients with knee OA were developed, providing guidance in clinical reasoning with regard to diagnostics and treatment. To evaluate the effectiveness of treatment in line with our protocols, a randomized clinical trial should be performed.

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A PILOT RANDOMIZED CONTROL TRIAL OF AEROBIC CYCLING BEFORE TOTAL KNEE ARTHROPLASTY

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Purpose: The main purpose of the study was to determine if a full trial of an aerobic cycling program for pre TKA (total knee arthroplasty) patients was feasible, by assessing recruitment, safety, ability to cycle, program adherence and aerobic benefit. Secondary objectives were to estimate sample size for a future full trial and conduct an exploratory assessment for change in outcome measures (pain, physical function, quality of life) from pre to post intervention to post surgery.
Methods: The trial was a pilot study with a prospective, randomized control design. In order to be eligible for the study, patients had to meet the following inclusion criteria: have a primary diagnosis of OA of the knee and be on a waiting list for TKA in the Calgary Health Region, agree to attend multiple fitness assessments and a thrice per week, on-site cycling program over 10 weeks before surgery. Patients that were randomized to the exercise group enrolled in an aerobic cycling program to attend three cycling sessions per week over 10 weeks before their surgical date. Each of the cycling sessions was 30 minutes in duration, with 5 minutes used for a warm-up period at the start and 5 minutes as a cool-down period at the 25 minute mark. The middle 20 minutes was an aerobic exercise period where patients cycled at an intensity that could improve cardiorespiratory fitness (70-85% of their heart rate maximum).
Results: A total of 21 pre TKA patients (12 exercise group, 9 control group) were enrolled in the study. There were no statistically significant differences in the baseline demographics, baseline questionnaires or VO2 max bike results, between the exercise and control groups.
The percentage recruited was 8.3% (21/254). The ineligible patients ($n = 295$), had a mean age of 67.8 (9.7) and 61% female. The mean age of declined eligible patients ($n = 233$) was 64.7(8.4) and 54% were females. Only 1/9 patients in the control group was unable to complete their post intervention submaximal bike test due to knee pain. For patients in the exercise group, there were no adverse events due to the cycling sessions that caused patients to cease cycling or seek medical attention.
Pacing in the cycling sessions was an initial problem in 3/12 exercise group patients who needed the first three to seven sessions to achieve the required intensity of the exercise program. A total of 38/360 sessions were missed amongst the 12 participants with an overall attendance rate of 89%.
A paired t test demonstrated a statistically significant improvement in VO2 max for the exercise group from pre to post intervention. There was no difference in mean V02 max between groups from pre to post intervention (post mean VO2max, E:25.3±6.30, C: 23.9±11.06, $p = .754$).
Repeated measures ANOVA revealed a significant change in mean WOMAC pain ($F(2,31)=10.26$, $p \leq .001$) and physical function ($F(2,31)=11.17$, $p \leq .001$) scores and SF-36 pcs score ($F(2,30)=5.53$, $p = .009$) over time but no group effect. Further assessment revealed a significant improvement in these scores from pre surgery to three months post TKA (WOMAC subscales, $p \leq .001$, SF-36, $p = .004$). Although the difference in mean WOMAC physical function scores between the exercise and control group widened (by 7 points) from pre to post intervention, this change was not statistically significant.
Conclusions: In this study, it was demonstrated that patients without heart disease and younger than age 80, can safely undertake an aerobic cycling program before TKA surgery. If severe knee OA patients can tolerate aerobic cycling, then this mode of exercise has potential to assist in reduction of weight and improvement of overall health and well-being. Further exploration with a larger sample size, possibly in a multi-centre trial, would be necessary to determine possible pain and physical function benefits from aerobic cycling, before or after knee replacement surgery.

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INCREASED NUMBER OF SUBJECTS WITH ELEVATED LEVELS OF BLOOD GLUCOSE (HBA1C) AFTER PROLONGED GLUCOSAMINE USAGE AMONG OVERWEIGHT AND OBESE WOMEN

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Purpose: In a recent systematic review, negative effects of prolonged glucosamine usage on glucose metabolism were more likely among subjects with impaired insulin resistance or glucose tolerance. Despite this, glucosamine is recommended for the management of osteoarthritis (OA) in international guidelines and is freely available over the counter. The objective of the present study was to evaluate the effect of a 2.5 years placebo controlled intervention with oral crystalline glucosamine sulphate on HbA1c levels in middle-aged women with a BMI $\geq$ 27 kg/m2 and therefore already at increased risk for impaired glucose tolerance.
Methods: Data from the first preventive RCT in OA (the PROOF study) were used. In total, 407 women between 50 and 60 years, with a BMI $\geq$ 27 kg/m2, without clinical and radiographic knee OA at baseline were randomized over oral crystalline glucosamine sulphate and placebo. At baseline, 1 year, and 2.5 years, HbA1c level was determined in all subjects. Using restricted maximum likelihood methods, the effect of glucosamine usage on HbA1c level throughout the follow-up period was determined in all subjects. Thereafter, analyses were rerun for subjects with and without elevated HbA1c level ($\geq$ 42 mmol/mol) at baseline. These analyses were adjusted for possible covariates (age, BMI, physical activity level at baseline and change over 30 months, change in waist circumference, and season of baseline measurement). Finally, the risk of attaining an elevated level of HbA1c ($\geq$ 42 mmol/mol) after 2.5 years was determined for the glucosamine group relative to the placebo group, additionally adjusted for having an elevated level of HbA1c at baseline.
Results: At baseline mean age of the 407 included women was 55.7 $\pm$ 3.2 years and mean BMI was 32.4 $\pm$ 4.3 kg/m2. HbA1c levels were